Listing of the Claims

Please amend claims 1 and 9, and add new claims 11-16 as indicated below. This listing of claims replaces all prior versions.

1. (Currently amended) A method for subtracting quantization noise from a pulse code modulated PCM signal being segmented into frames, comprising the steps of:

calculating for each frame of said PCM signal a constant quantization noise level Bq according to the following equation:

$$B_q = \sqrt{\sum_{n=0}^{W-1} \frac{\{(s^*_{\min}[n] - s^*_{\max}[n]) \cdot w[n]\}^2}{12}}$$

wherein

n: indicates a specific sample of the PCM signal; $S^*_{min}{}^{[n]}$: represents the minimum quantization noise level for a specific sample value s*[n] of said PCM signal; $S^*_{max}{}^{[n]}$: represents the maximum quantization noise level for the specific sample value s*[n] of the PCM signal, wherein $S^*_{min}{}^{[n]}$ - $S^*_{max}{}^{[n]}$ has a different value for at least two specific samples n respectively;

w[n]: represents a window-function; and

W: represents the number of samples per window; and

subtracting the quantization noise as represented by said quantization noise level Bq from said PCM signal.

2. (Original) The method according to claim 1, characterized in that the minimum quantization level S^*_{min} as well as the maximum quantization level S^*_{max} are known.

3. (Previously presented) The method according to claim 1, characterized in that the minimum quantization level S^*_{min} and the maximum quantization level S^*_{max} are predicted according to the following equations:

$S^*_{min}=i[n]-(i[n]-i_{min}[n])/2$

$S^*_{max}=i[n]+(i_{max}[n]-i[n])- /2$

wherein

i: represents one out of a plurality of possible representation levels predefined due to the specific PCM quantization method applied to an original signal;

i[n]: represents that predefined representation level which corresponds to the sample value s*[n] for a specific n;

i_{min}[n]: represents that representation level which is--started from i[n]--the next smaller non-zero representation level for which u[n]=1;

i_{max}[n]: represents that representation level which is---started from i[n]--the next bigger non-zero representation level for which u[n]=1;

with the usage array u[i] being defined to:

$$u(i) = \min\left(1, \sum_{n=0}^{L-1} \begin{cases} 0, & s^*[n] \neq i \\ 1, & \text{otherwise} \end{cases}\right), \ -2^{N-1} \leq i < 2^{N-1}$$

wherein

L: represents the number samples of the whole PCM-signal; and

N: represents the number of bits used for quantizing an original sample value by using PCM to generate the PCM sample values s*[n].

4. (Previously presented) The method according to claim 1, characterized in that the subtracting of the quantization noise represented by said quantization noise level Bq from the PCM-signal is carried out in the frequency domain according to the following steps:

computing the spectrum S*[k] of the PCM signal s*[n] and forming the magnitude |S*[k]| thereof;

computing a signal-to-noise ratio SNR[k] of said spectrum S*[k] according to: *SNR[k]=|S*[k]|/Bq;*

calculating from said signal-to-noise ratio SNR[k] a filter magnitude F[k] according to a predefined filter algorithm based on at least one filter update parameter;

calculating an output spectrum S^b[k] at least substantially free of said quantization noise by multiplying both the real part R{S*[k]} and the imaginary part I{S*[k]} of the spectrum S*[k] with said filter magnitude F{k}; and

transforming the output spectrum $S^b[k]$ back into a signal $s^b[n]$ in the time domain.

5. (Original) The method according to claim 4, characterized in that the filter update parameter and thus the filter magnitude F[k] are adjusted such that the quantization noise in the remaining output spectrum $S^b[k]$ is as low as possible.

6. (Original) The method according to claim 4, characterized in that it further comprises the steps of:

weighting the frames of the input PCM signal with a first window w1[n] and calculating the spectrum S*[k] from said weighted signal;

generating a weighted output signal $s^b_w[n]$ by weighting the signal $s^b[n]$ received after the re-transformation with a second window W2[n]; and

calculating a final output signal $S_w^b[n]$ for a current frame of the PCM-signal from said weighted output signal $s^b_w[n]$ such that the transition between two successive output frames and is smoothed.

7. (Original) The method according to claim 4, characterized in that the computation of the spectrum S*[k] of the PCM signal is done by using a Fast Fourier Transformation FFT; and

the re-transforming the output spectrum $S^b[k]$ back into a time domain signal $s^b[n]$ is done by using an inverse FFT.

8. (Original) The method according to claim 6, characterized in that the first and the second window w1 and w2 are identical.

9. (Currently amended) A quantization noise subtracting unit for subtracting quantization noise from a pulse code modulated PCM signal being segmented into frames, comprising:

a quantization noise level calculating unit for calculating for each frame of said PCM signal a constant quantization noise level Bq according to the following equation:

$$B_q = \sqrt{\sum_{n=0}^{W-1} \frac{\{(s^*_{\min}[n] - s^*_{(3)\max}[n]) \cdot w[n]\}^2}{12}}$$

wherein

n: indicates a specific sample of the PCM signal;

$S^*_{min}[n]$: represents the minimum quantization noise level for a specific sample value s*[n] of said PCM signal;

$S^*_{max}[n]$: represents the maximum quantization noise level for the specific sample value s*[n] of the PCM signal, <u>wherein $S^*_{min}{}^{[n]}$ - $S^*_{max}{}^{[n]}$ has a different value for at least two specific samples n respectively</u>;

w[n]: represents a window-function; and

W: represents the number of samples per window; and

a background noise subtracting unit for subtracting the quantization noise as represented by said quantization noise level Bq from said PCM signal.

10. (Previously presented) The noise subtracting unit according to claim 9, characterized in that it is located at a decoder's side.

11. (New) The noise subtracting unit according to claim 9, characterized in that the minimum quantization level S^*_{min} and the maximum quantization level S^*_{max} are predicted according to the following equations:

$S^*_{min}=i[n]-(i[n]-i_{min}[n])/2$

$S^*_{max}=i[n]+(i_{max}[n]-i[n])- /2$

wherein

i: represents one out of a plurality of possible representation levels predefined due to the specific PCM quantization method applied to an original signal;

i[n]: represents that predefined representation level which corresponds to the sample value s*[n] for a specific n;

$i_{min}[n]$: represents that representation level which is--started from i[n]--the next smaller non-zero representation level for which u[n]=1;

$i_{max}[n]$: represents that representation level which is---started from i[n]--the next bigger non-zero representation level for which u[n]=1;

with the usage array u[i] being defined to:

$$u(i) = \min\left(1, \sum_{n=0}^{L-1} \begin{cases} 0, & s^*[n] \neq i \\ 1, & \text{otherwise} \end{cases}\right), \quad -2^{N-1} \leq i < 2^{N-1}$$

wherein

L: represents the number of samples of the whole PCM-signal; and

N: represents the number of bits used for quantizing an original sample value by using PCM to generate the PCM sample values s*[n].

12. (New) The noise subtracting unit according to claim 9, characterized in that the background subtracting unit subtracts the quantization noise represented by said quantization noise level Bq from the PCM-signal in the frequency domain according to the following steps:

computing the spectrum S*[k] of the PCM signal s*[n] and forming the magnitude |S*[k]| thereof;

computing a signal-to-noise ratio SNR[k] of said spectrum S*[k] according to: *SNR[k]=|S*[k]|/Bq;*

calculating from said signal-to-noise ratio SNR[k] a filter magnitude F[k] according to a predefined filter algorithm based on at least one filter update parameter;

calculating an output spectrum $S^b[k]$ at least substantially free of said quantization noise by multiplying both the real part R{S*[k]} and the imaginary part I{S*[k]} of the spectrum S*[k] with said filter magnitude F{k}; and

transforming the output spectrum $S^b[k]$ back into a signal $s^b[n]$ in the time domain.

13. (New) The noise subtracting unit according to claim 12, characterized in that the filter update parameter and thus the filter magnitude F[k] are adjusted such that the quantization noise in the remaining output spectrum $S^b[k]$ is as low as possible.

14. (New) The noise subtracting unit according to claim 12, characterized in that the background subtracting unit subtracting the quantization noise represented by said quantization noise level Bq from the PCM-signal in the frequency domain further comprises the steps of:

weighting the frames of the input PCM signal with a first window $w1[n]$ and calculating the spectrum $S^*[k]$ from said weighted signal;

generating a weighted output signal $s^b_w[n]$ by weighting the signal $s^b[n]$ received after the re-transformation with a second window $W2[n]$; and

calculating a final output signal $S_w^b[n]$ for a current frame of the PCM-signal from said weighted output signal $s^b_w[n]$ such that the transition between two successive output frames is smoothed.

15. (New) The noise subtracting unit according to claim 12, characterized in that the computation of the spectrum $S^*[k]$ of the PCM signal is done by using a Fast Fourier Transformation FFT; and

the transforming of the output spectrum $S^b[k]$ back into the time domain signal $s^b[n]$ is done by using an inverse FFT.

16. (New) The noise subtracting unit according to claim 14, characterized in that the first and the second window w1 and w2 are identical.